FIG. Ia

FIG. Ib

FIG. Ic

FIG. Id

FIG. Ie

FIG. If

FIG. Ig

FIG. Ih

FIG. 2A

FIG. 2B

22

FIG. 2C

FIG. 2D

26   24
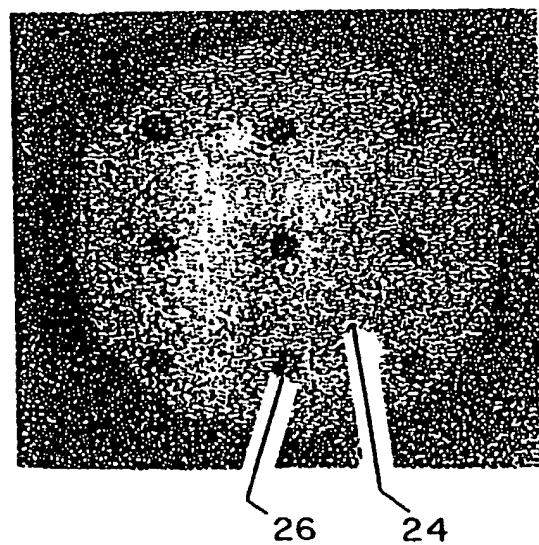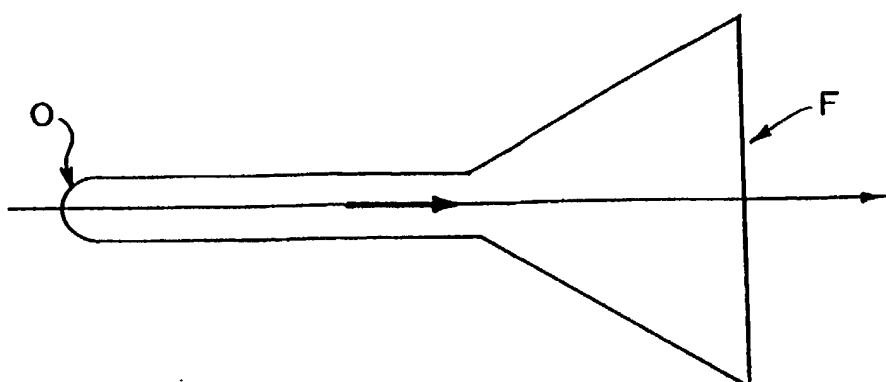
FIG. 3b
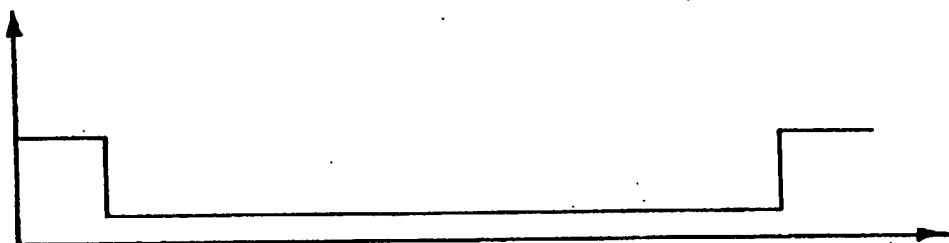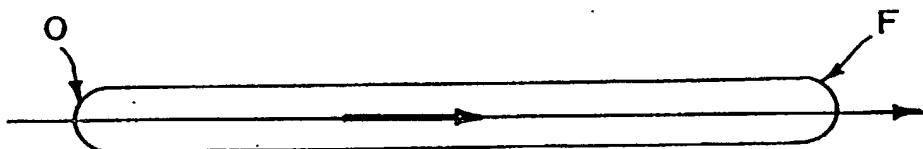
FIG. 3c

FIG. 3d

FIG. 3C
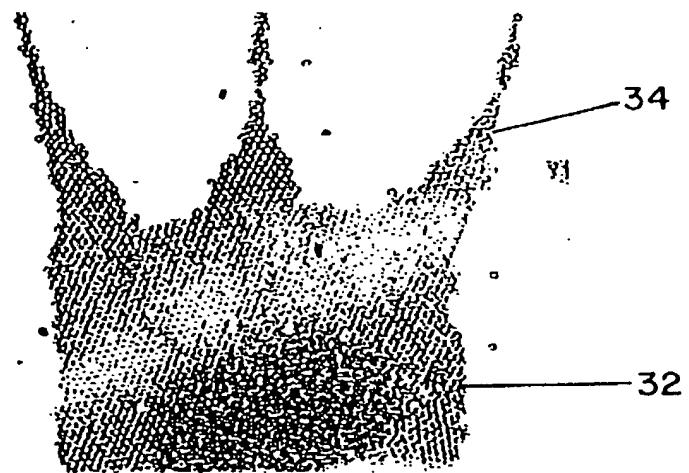
FIG. 3D
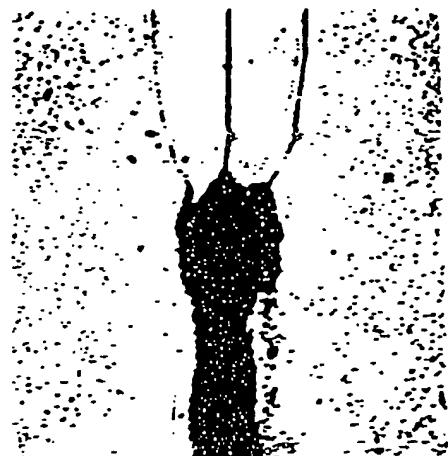
FIG. 4A

FIG. 4B

FIG. 5

FIG. 7

FIG. 6a

62

62'   64

FIG. 6b

FIG. 6c

FIG. 8

Post form Array

Form Complex on Planar Surface

Solid Phase (Pre-form Array)

Capture Complex

Form Complex on Bead

Form Complex in Solution

Mixed Phase

Liquid Phase

LEGEND

P — PROBE
T — TARGET
PT — P-T COMPLEX

FIG. 9a

Transverse Flow

Flow along Conduit

92

FIG. 9b

Illuminated Zone

FIG. 9c

FIG. 10

FIG. IIa

Local fluid velocity

FIG. IIb

FIG. IIc

Light

Light induced flow field
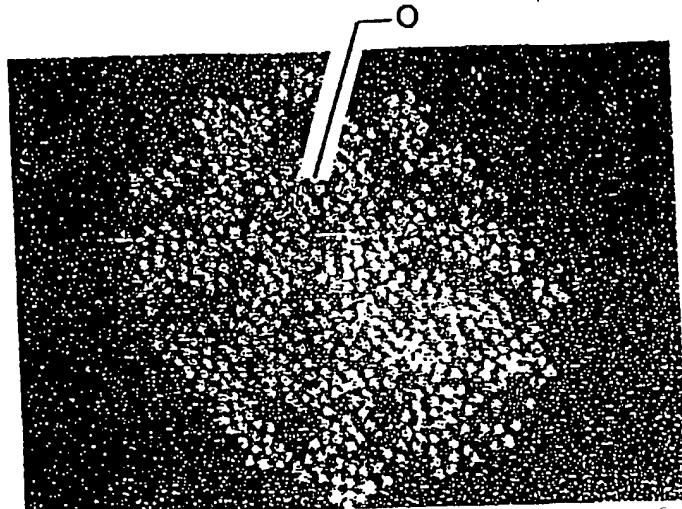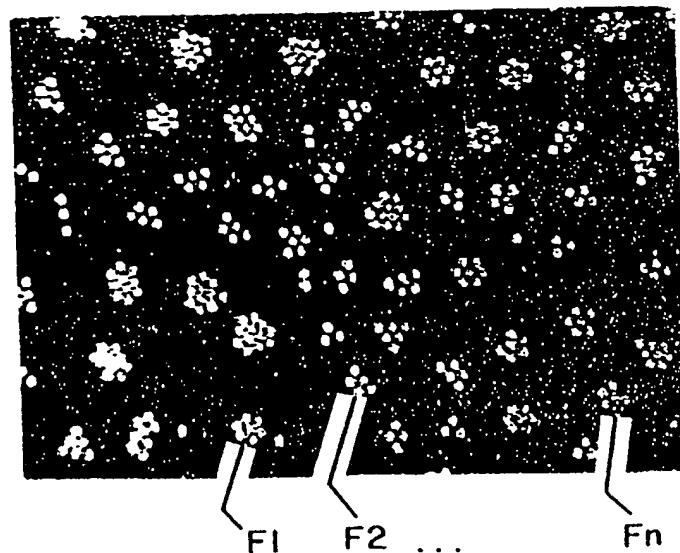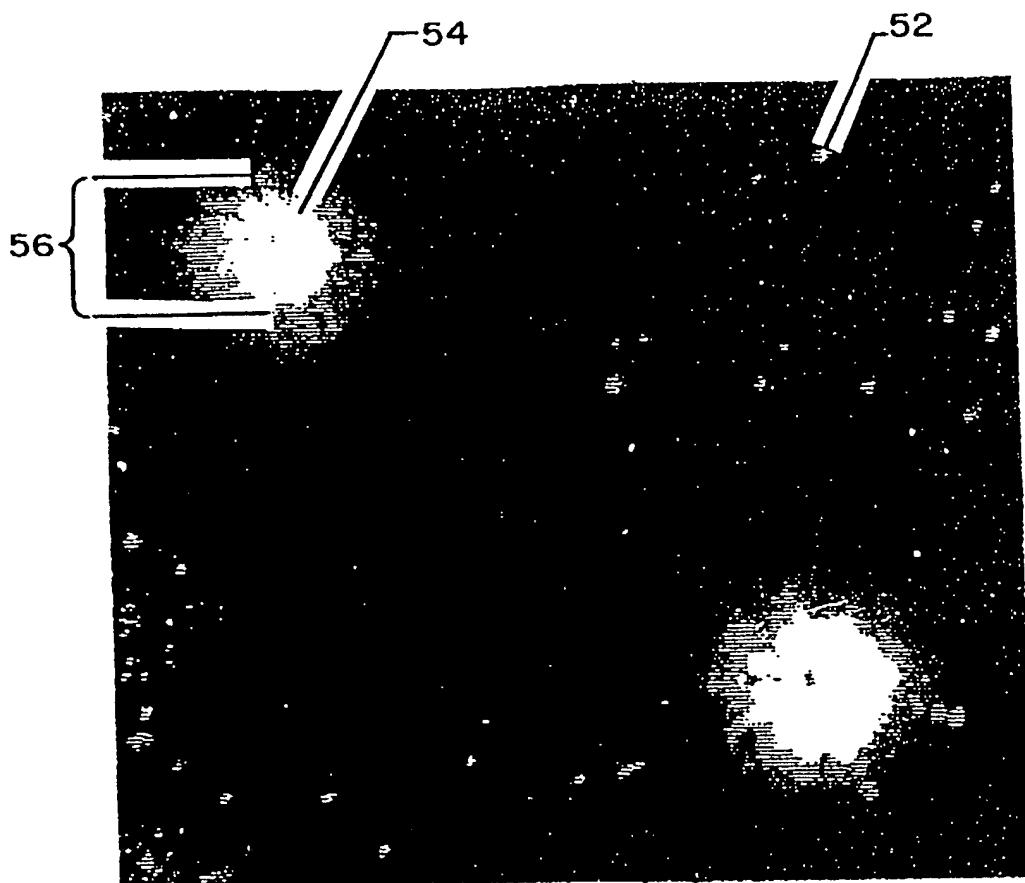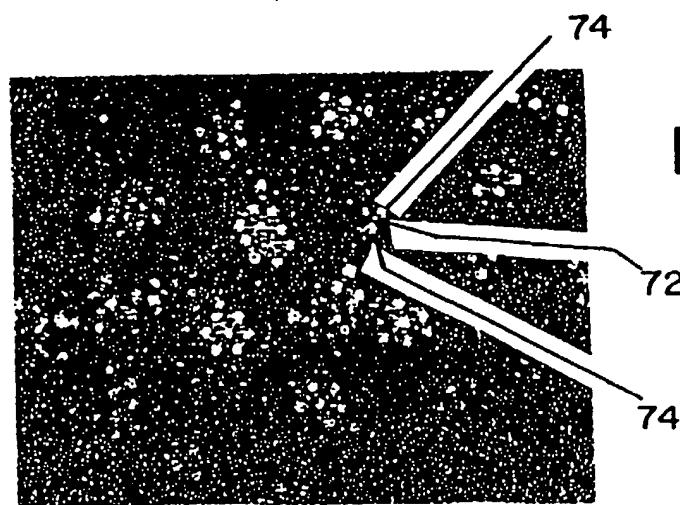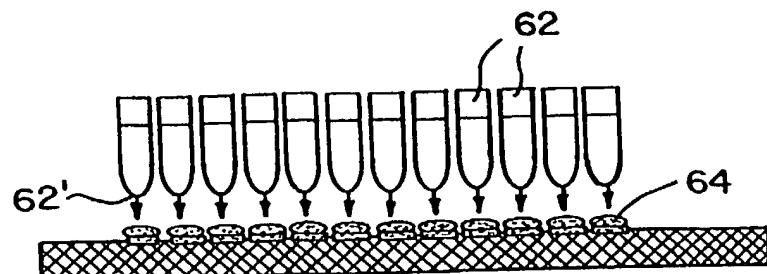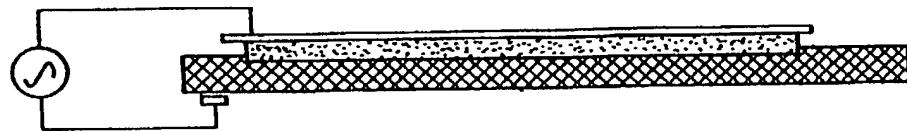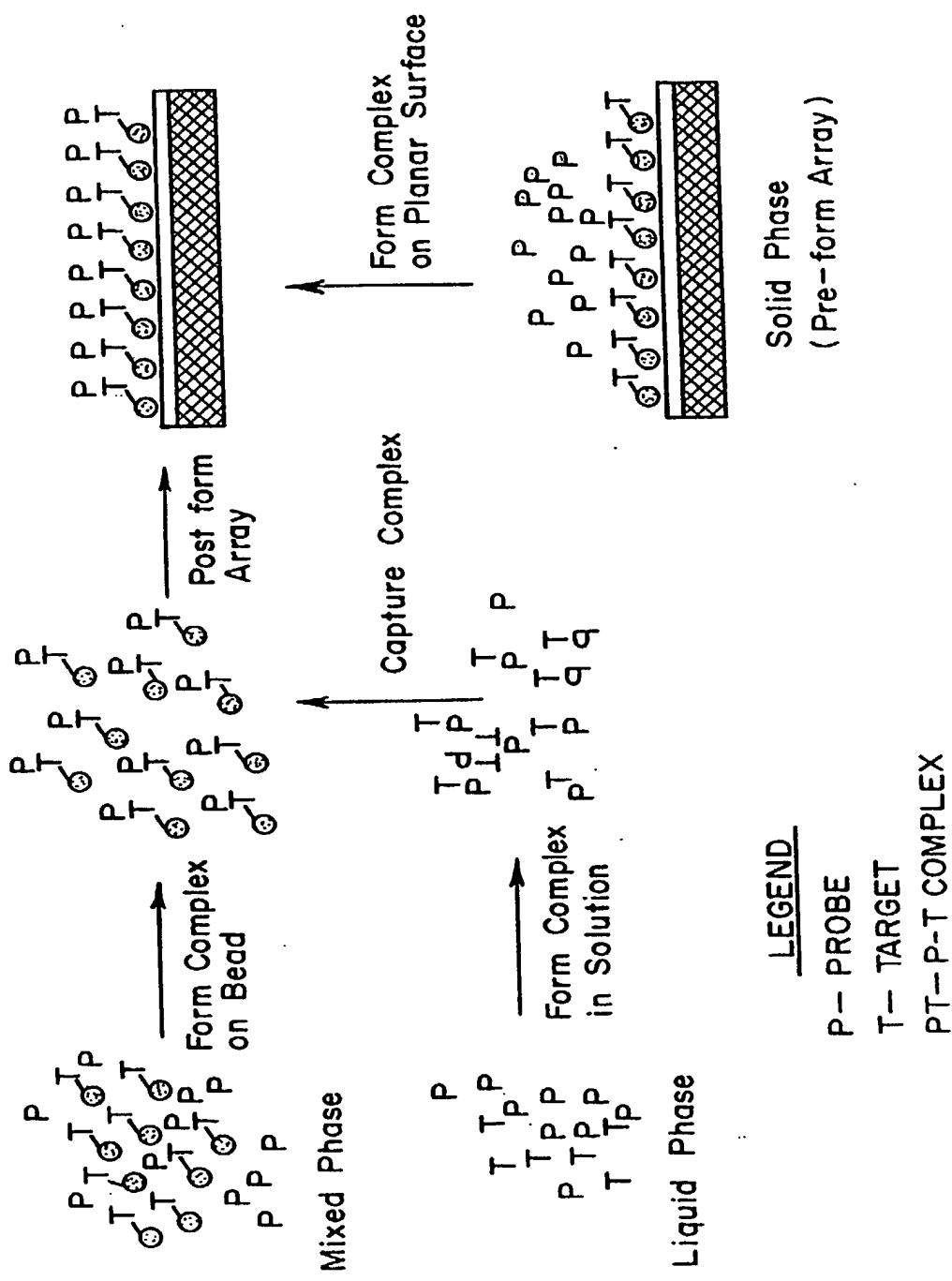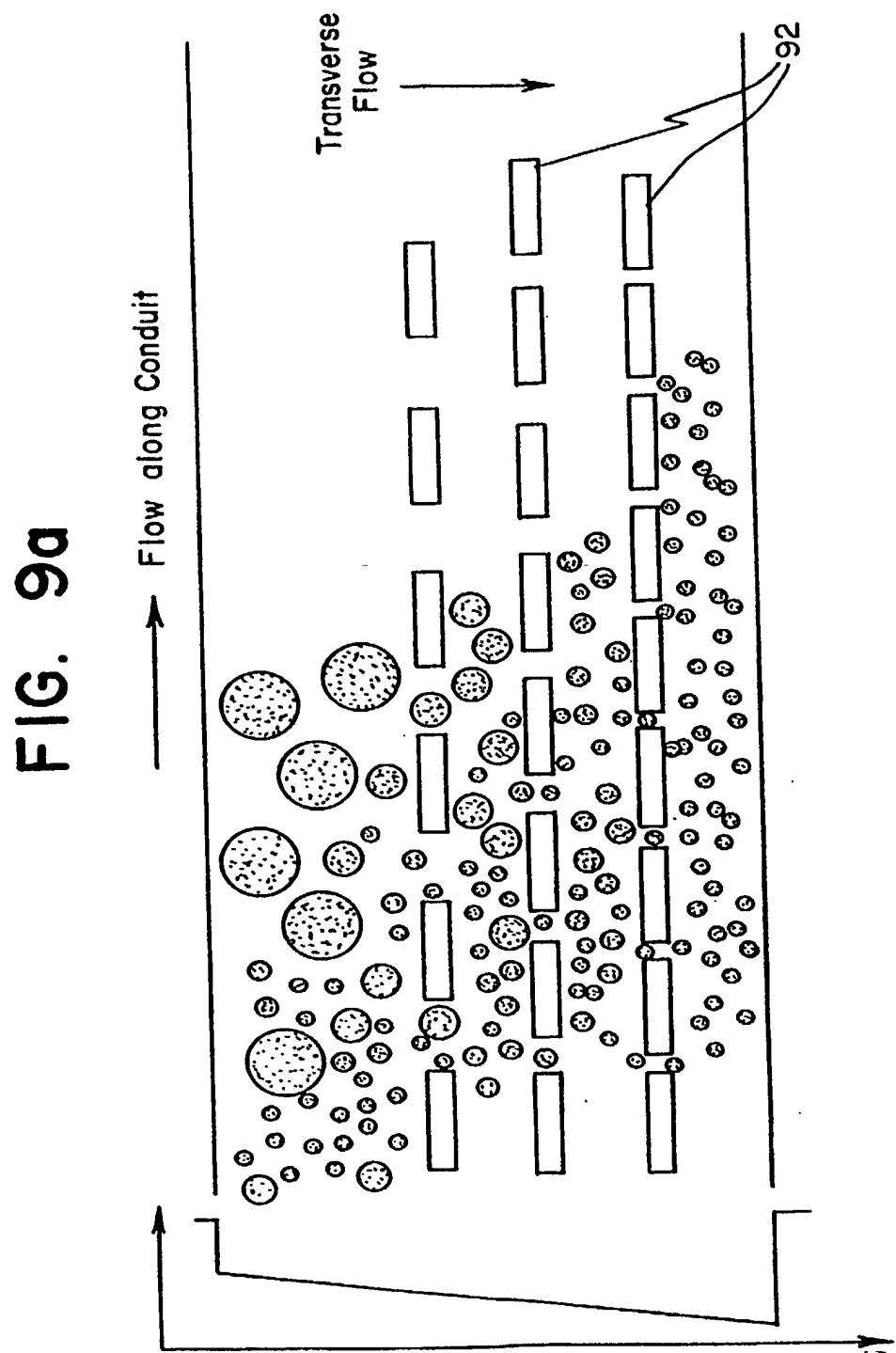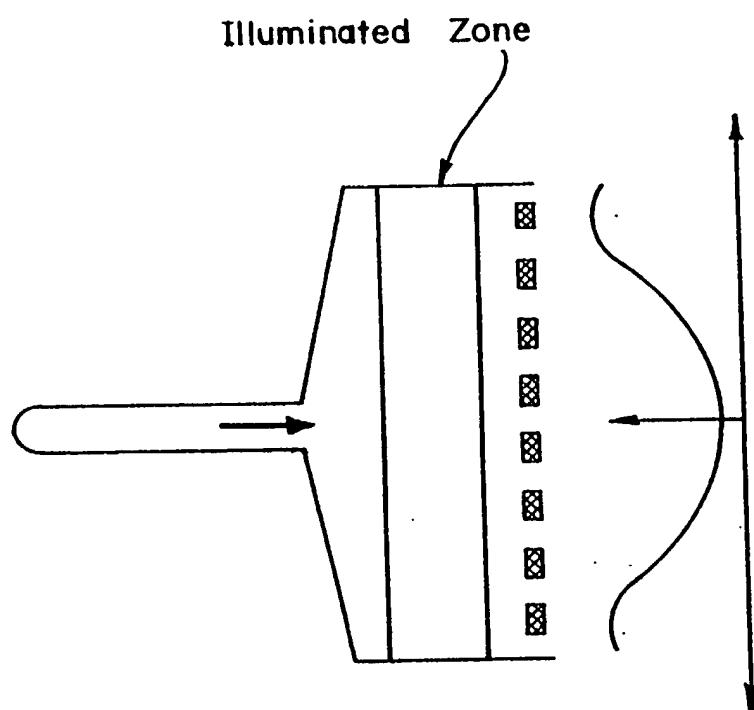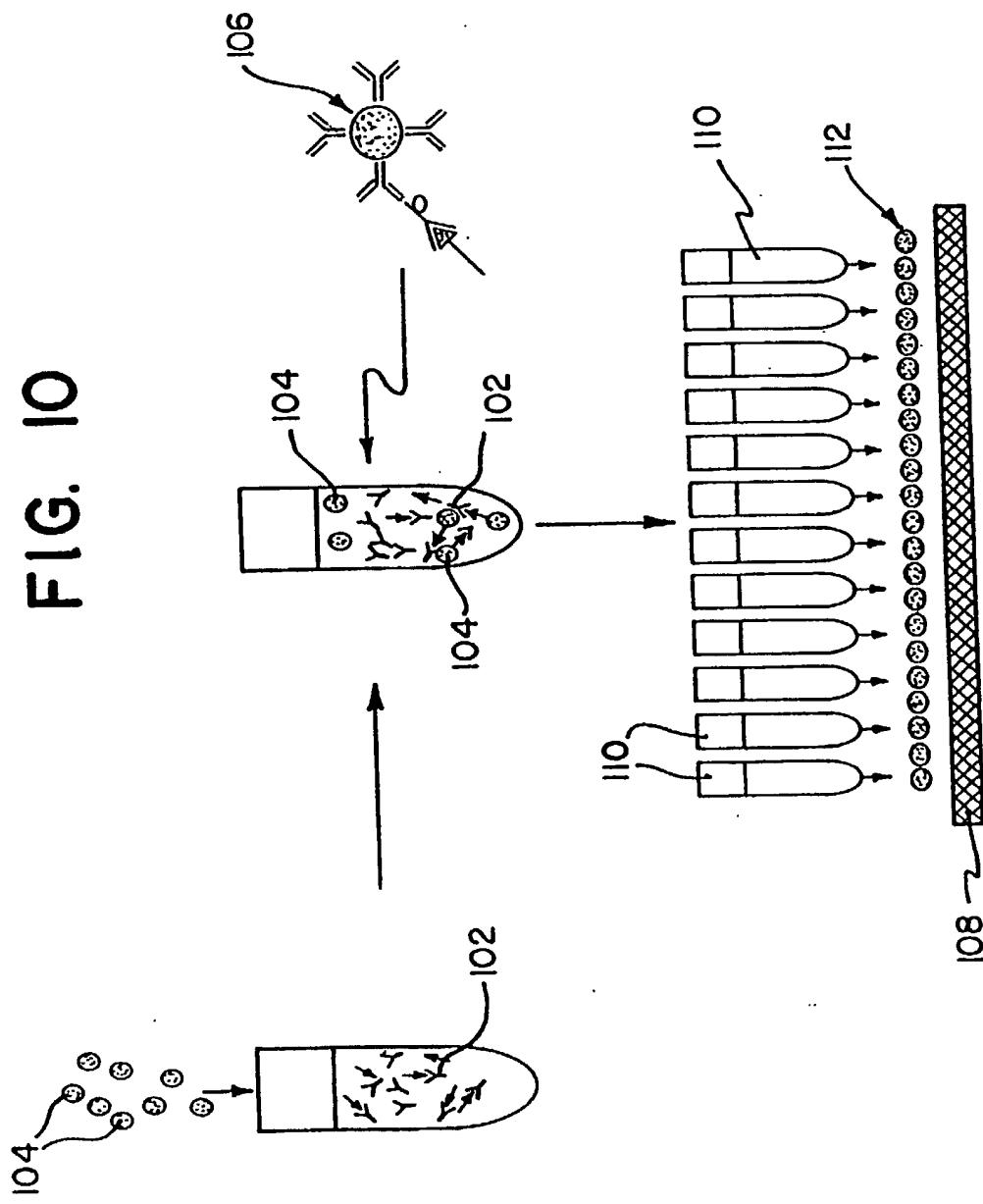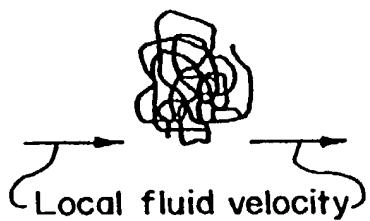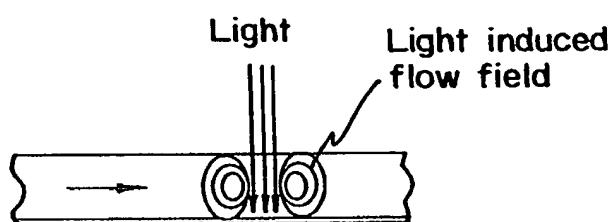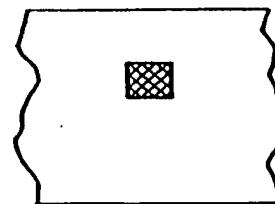
FIG. IId

FIG. IIe
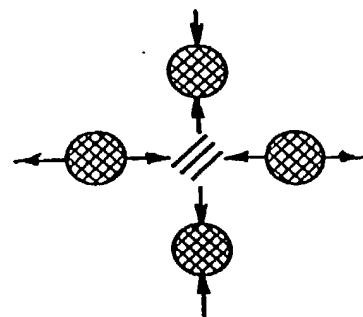
ILLUMINATION PATTERN GENERATOR

Observation Camera

Projected Illumination Pattern

LCD

VGA

Light Source

Application Software

PC

Illumination Pattern
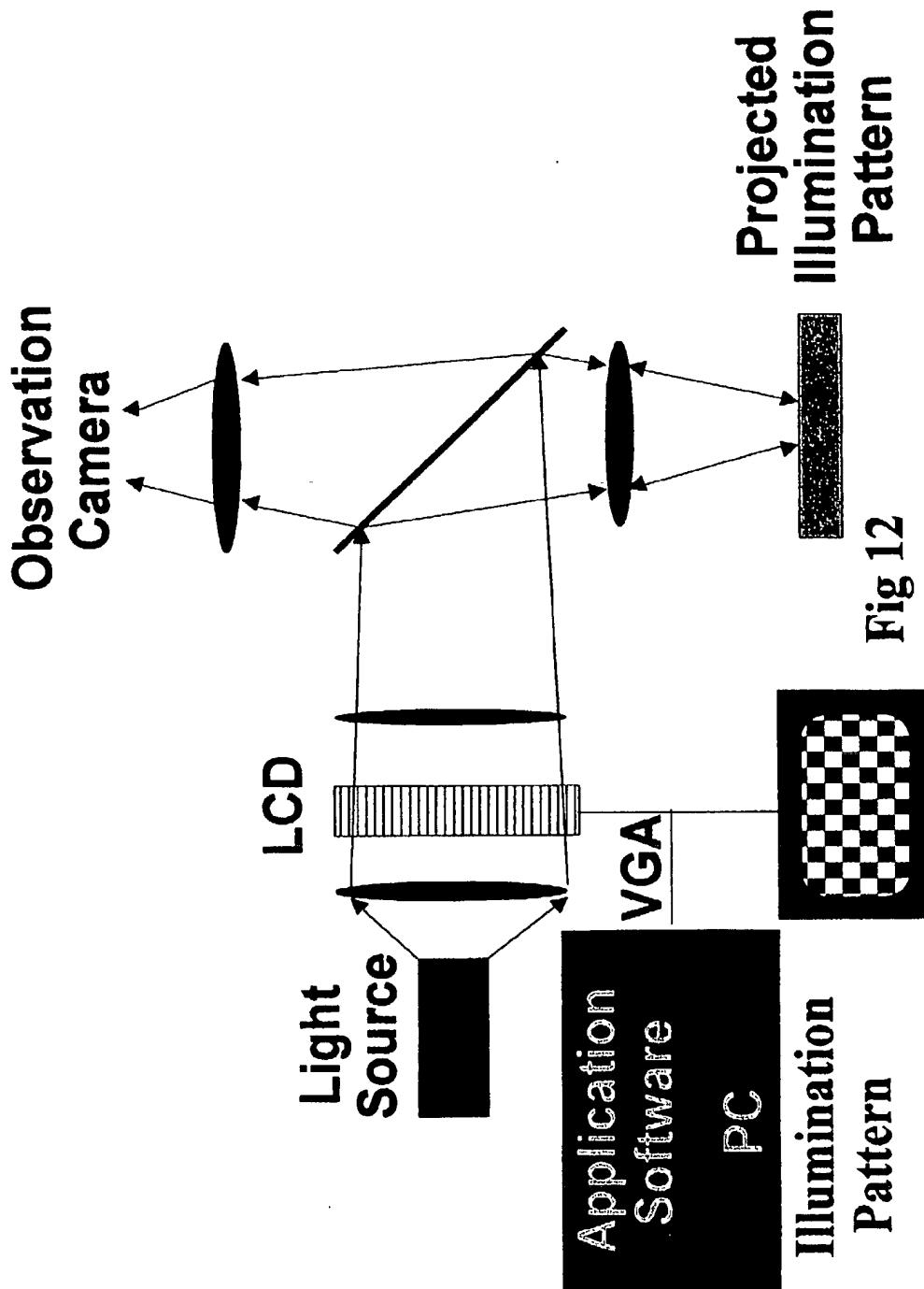
Fig 12

LCD-PARSE OPTICAL DESIGN

ON-LINE INSPECTION

CCD

L_C

OBJECTIVE LENS

SAMPLE

ILLUMINATION SYSTEM

L_C

LCD

L_I

LIGHT SOURCE
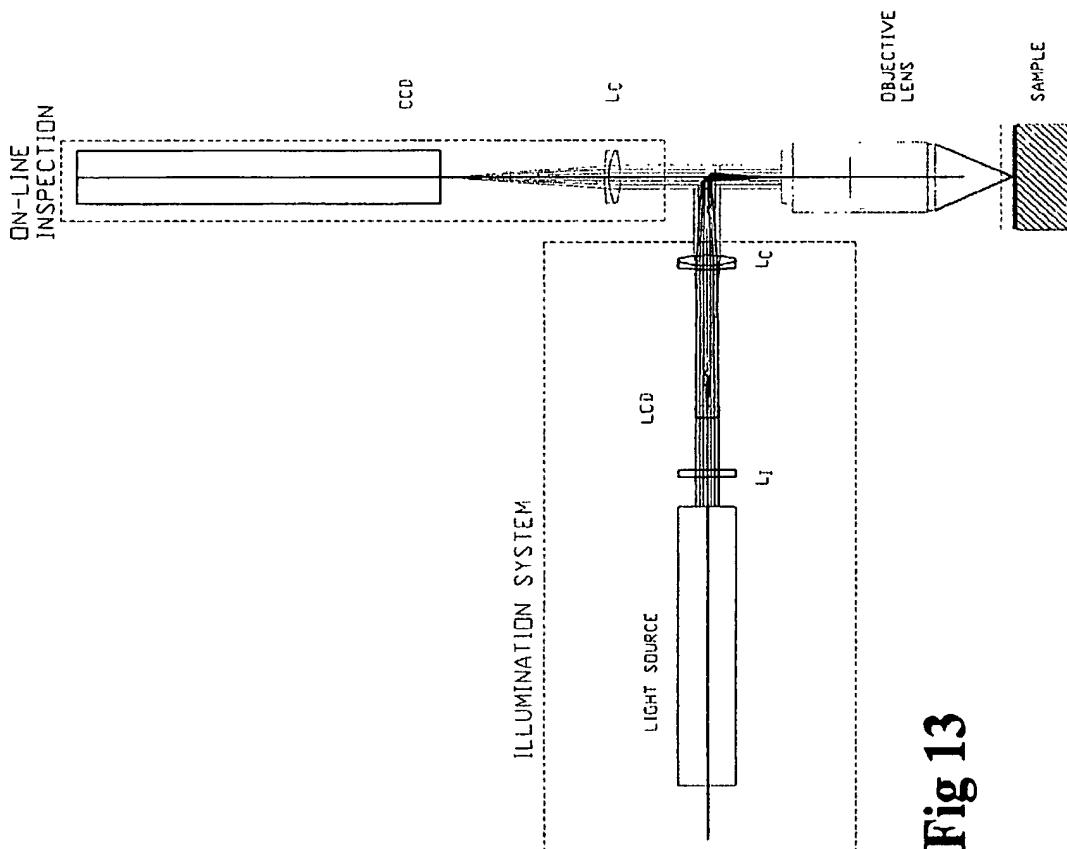
Fig 13

ARRAY SHAPE ADJUSTMENTS

CIRCLE

Figure 14a

HORIZONTAL LINE
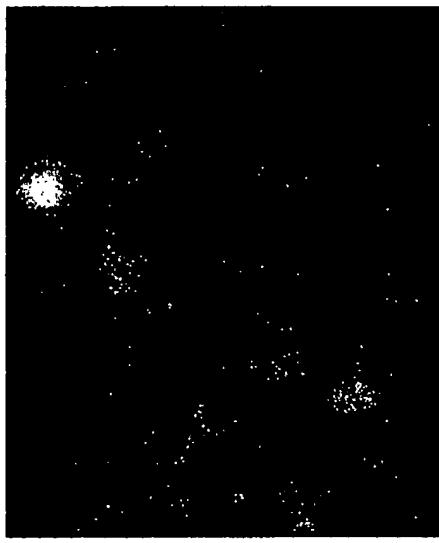
Figure 14c

VERTICAL LINE

Figure 14b

SQUARE
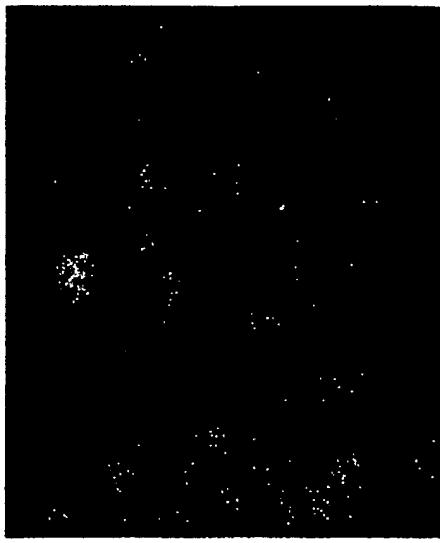
Figure 14d

COLLECTION AND ARRAY ASSEMBLY

CollectedParticles
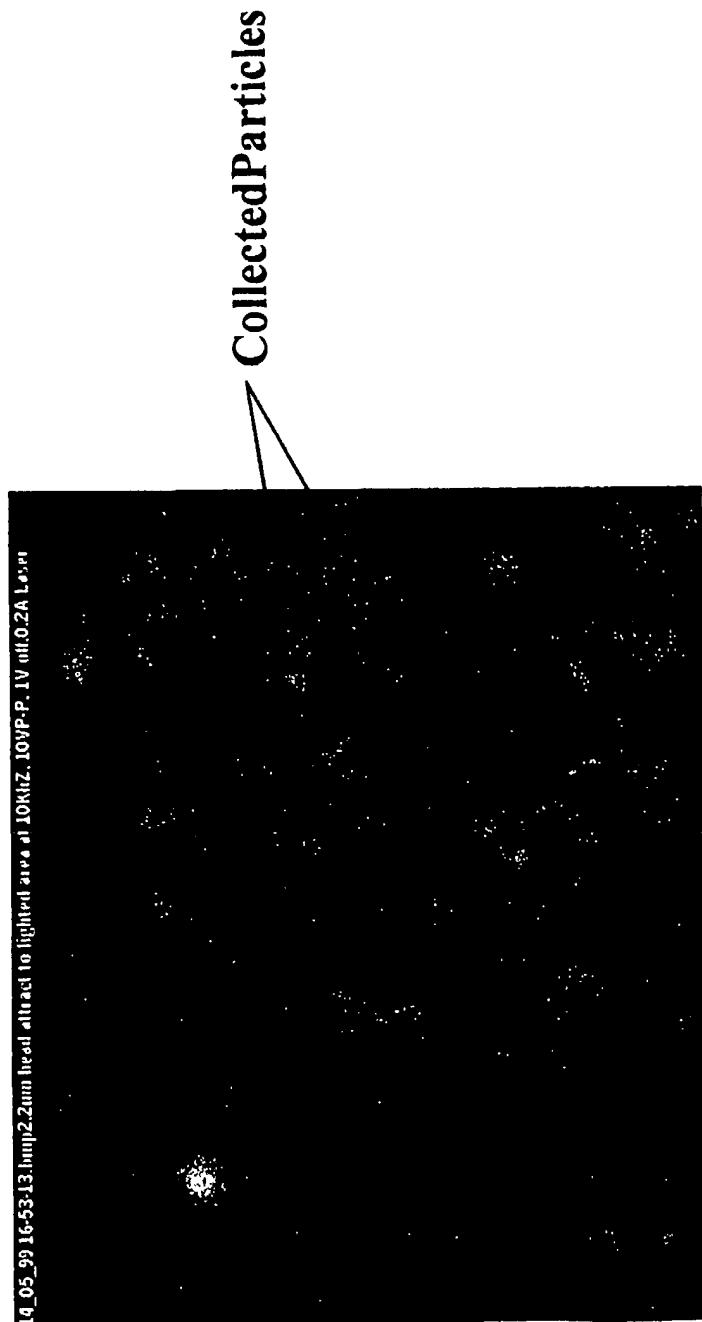
Figure 15a

EXPULSION AND CONFINEMENT
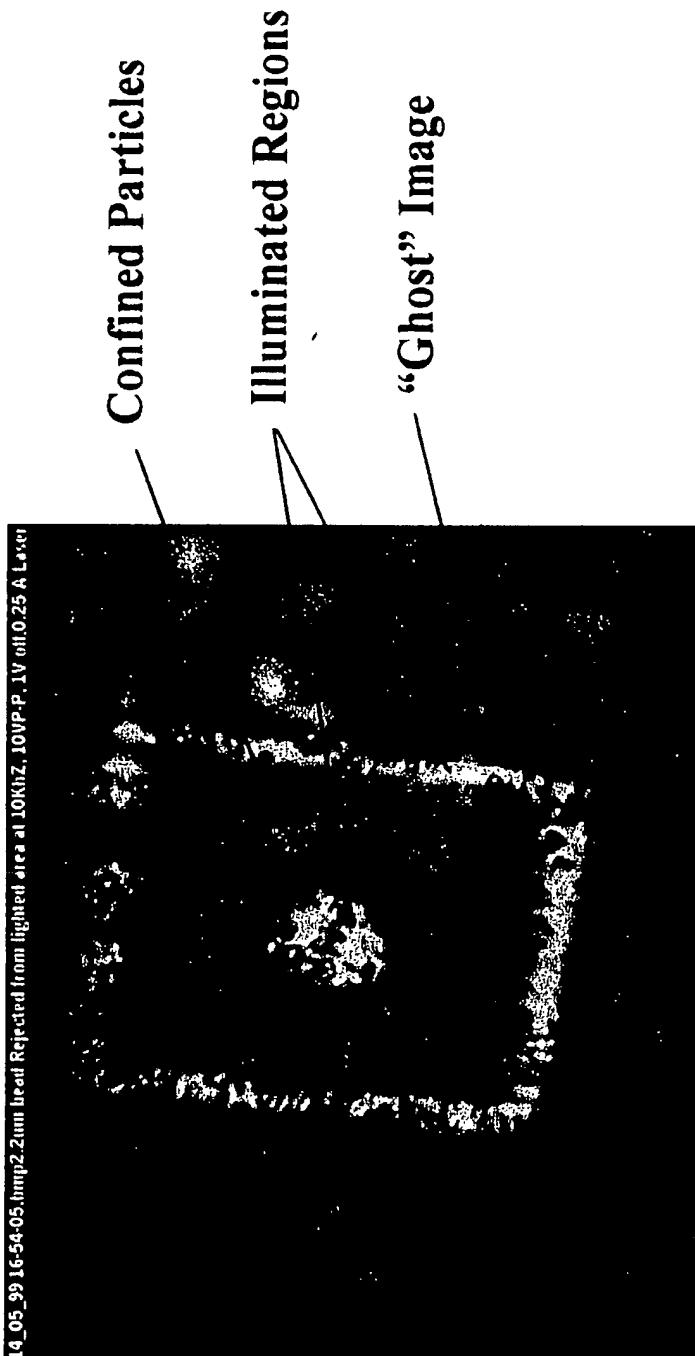
Confined Particles

Illuminated Regions

"Ghost" Image

Figure 15b

DRAG AND DROP
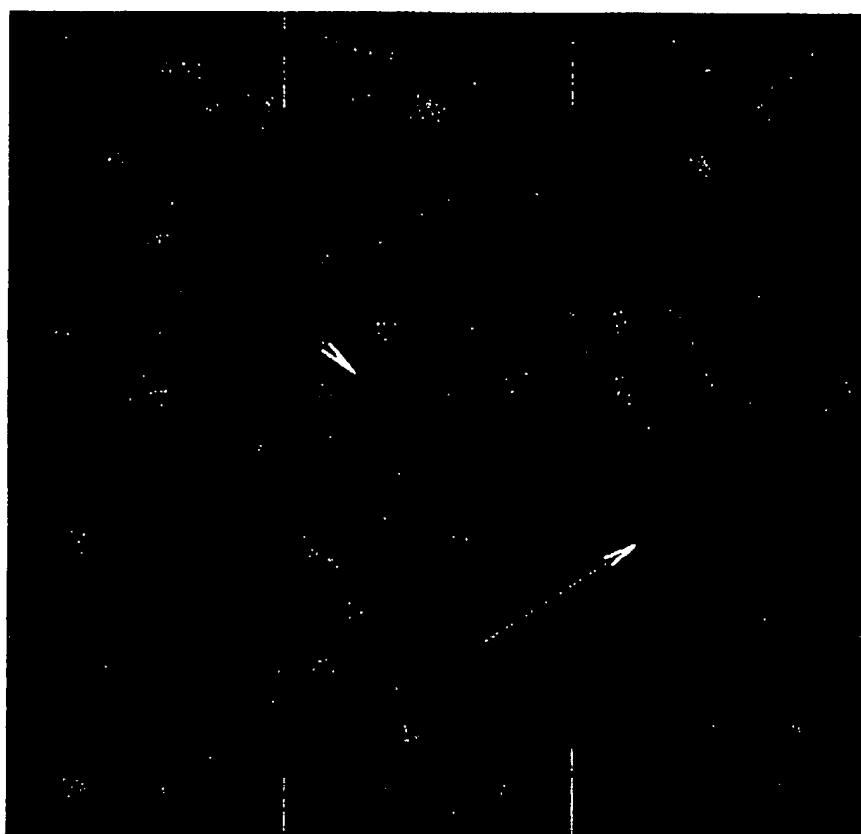
Figure 16

Porgrammable Array Reconfiguration and Segmentation

Illumination Profile

Dynamic Bead Array
with Labeled Subarray

Illumination of
Subarray Boundary

Array Segmentation
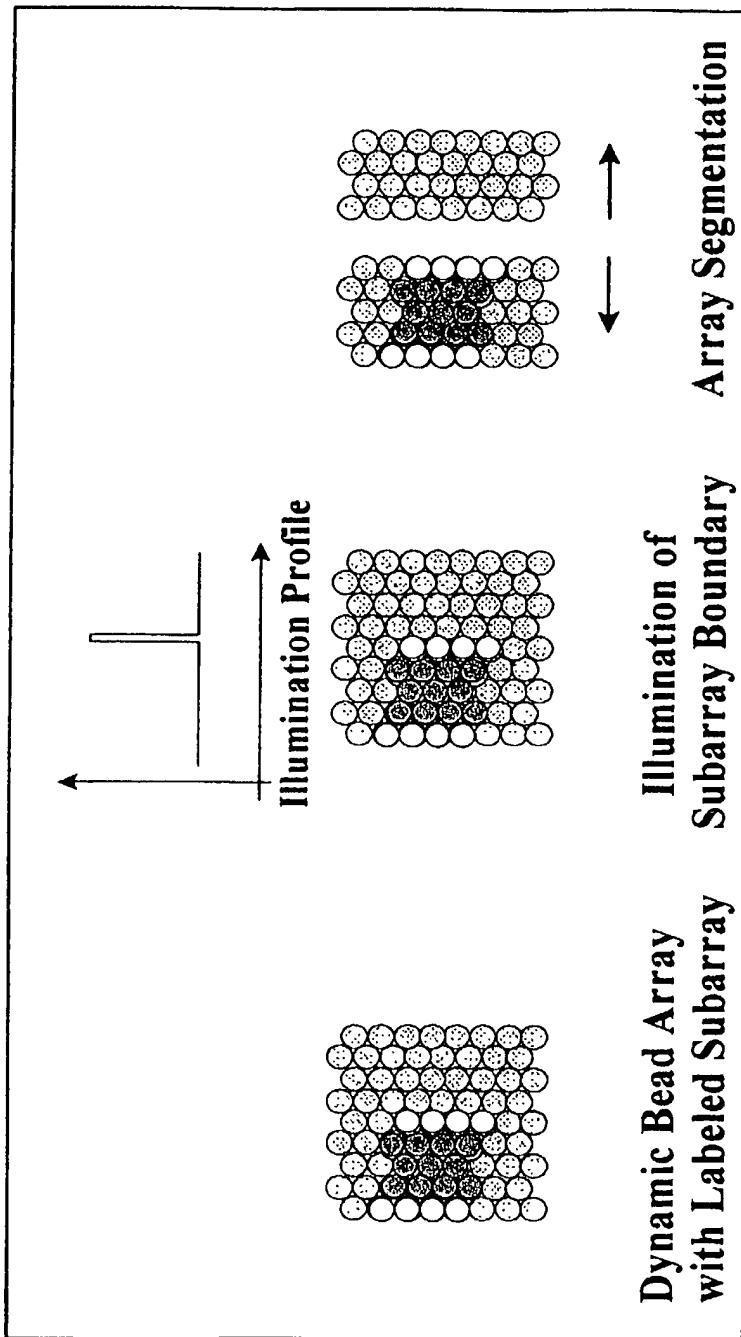
# Figure 17

LCD PARSE
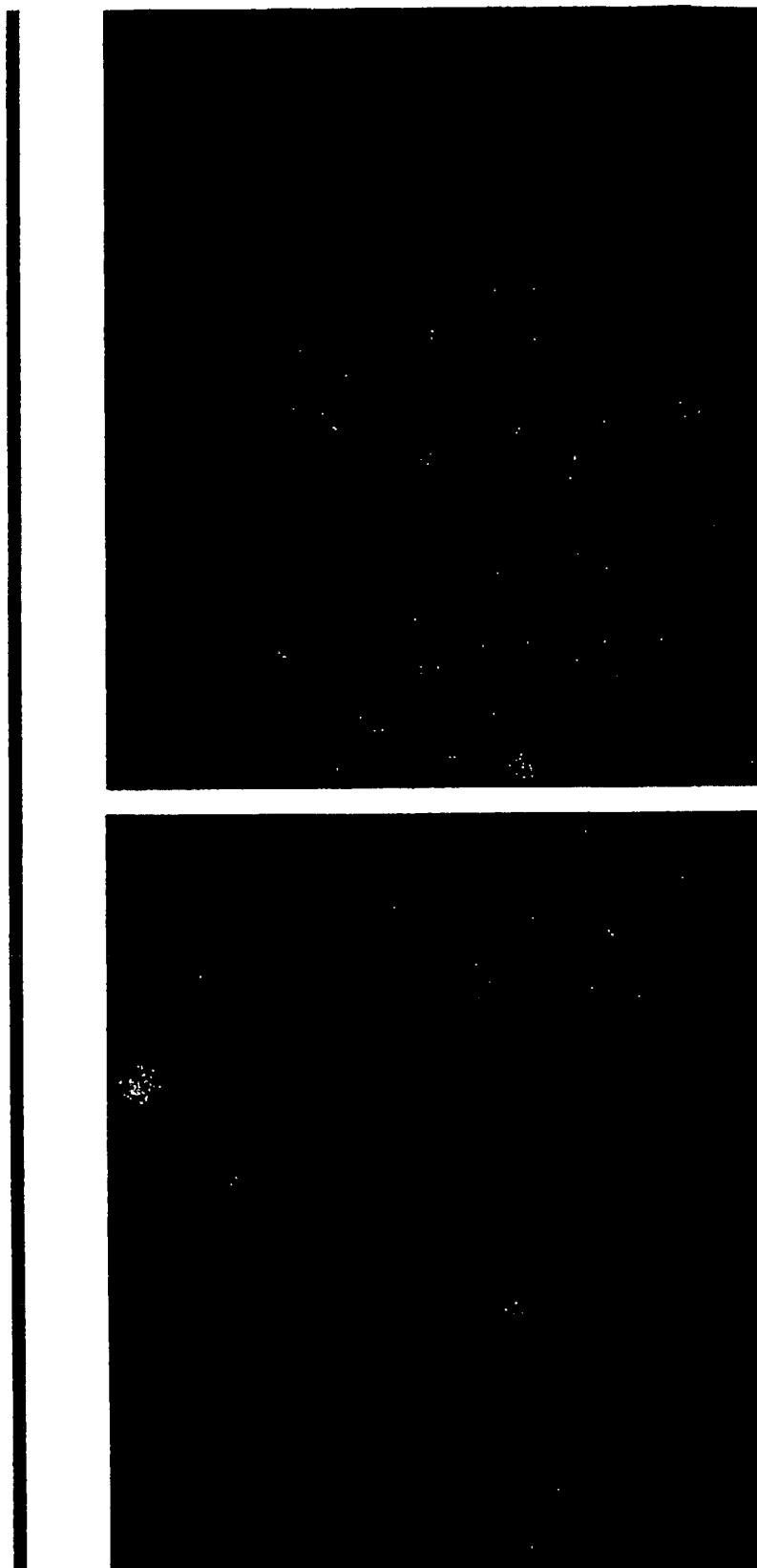
Figure 18b

Figure 18a
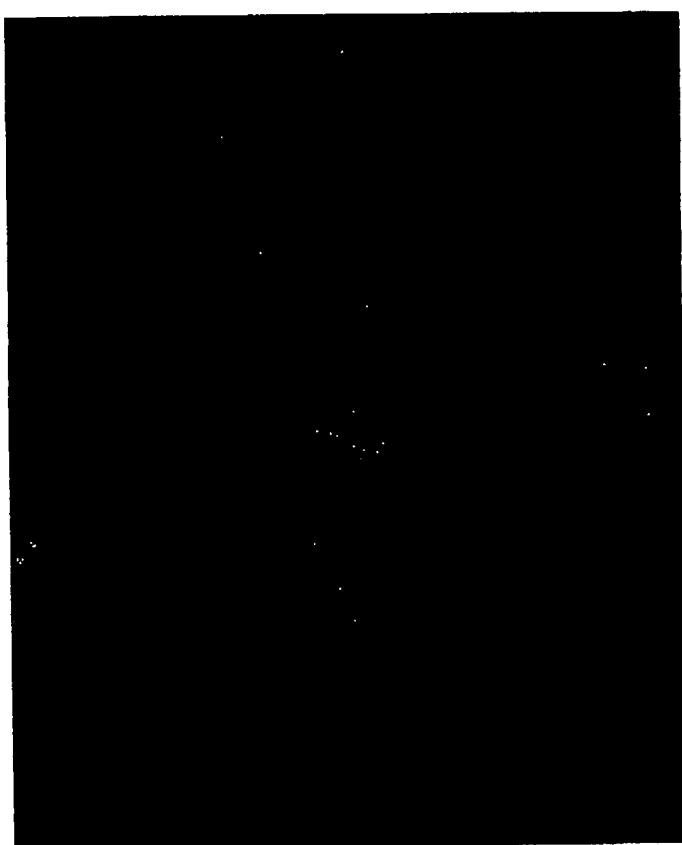
LCD PARSE

Figure 19

FRACTIONATION

Differential Frequency Dependence of Particle Expulsion
(NOTE: ω_c denotes a characeristic frequency)

Single Particle (Type 1)

Mixture (Types 1, 2)

Particle Type 1

Particle Type 2

Particle Collection and Array Assembly
$\omega < \omega\_c$

Particle Expulsion
$\omega\_c < \omega$

Differential Expulsion
$\omega\_c\,(1) < \omega < \omega\_c\,(2)$
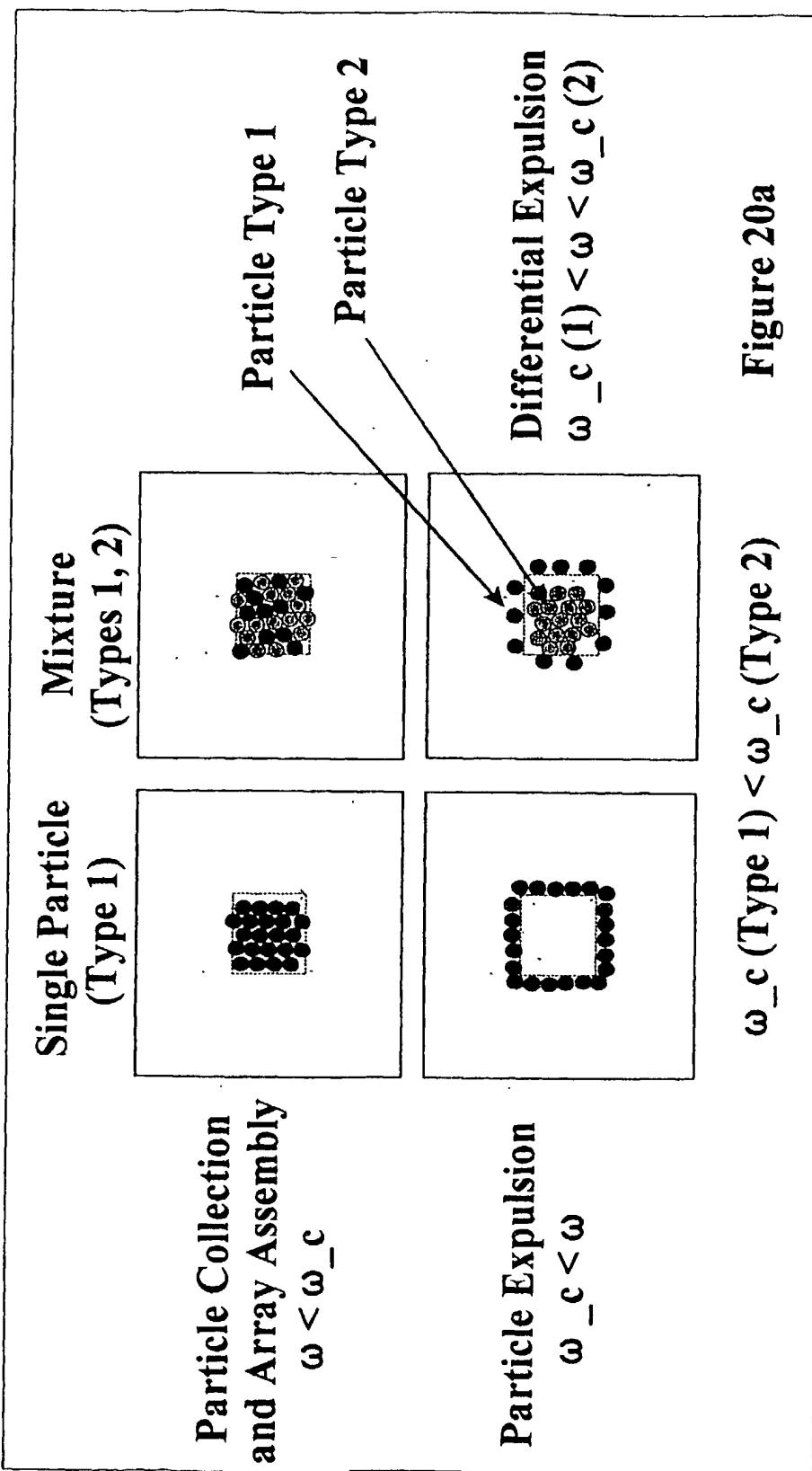
$\omega\_c\,(\text{Type 1}) < \omega\_c\,(\text{Type 2})$

Figure 20a

FRACTIONATION

Illuminated Region

Small particles collected in illuminated rgion

Large particles expelled from illuminated rgion
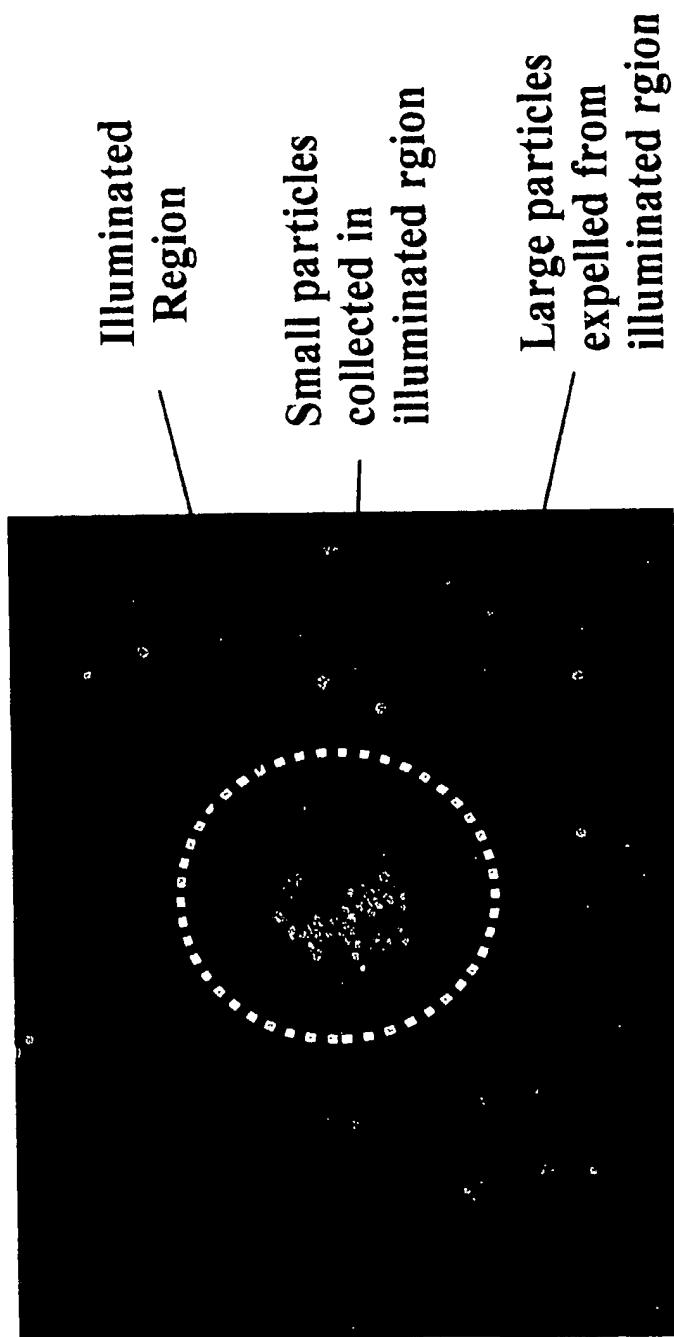
Figure 20b

LCD PARSE
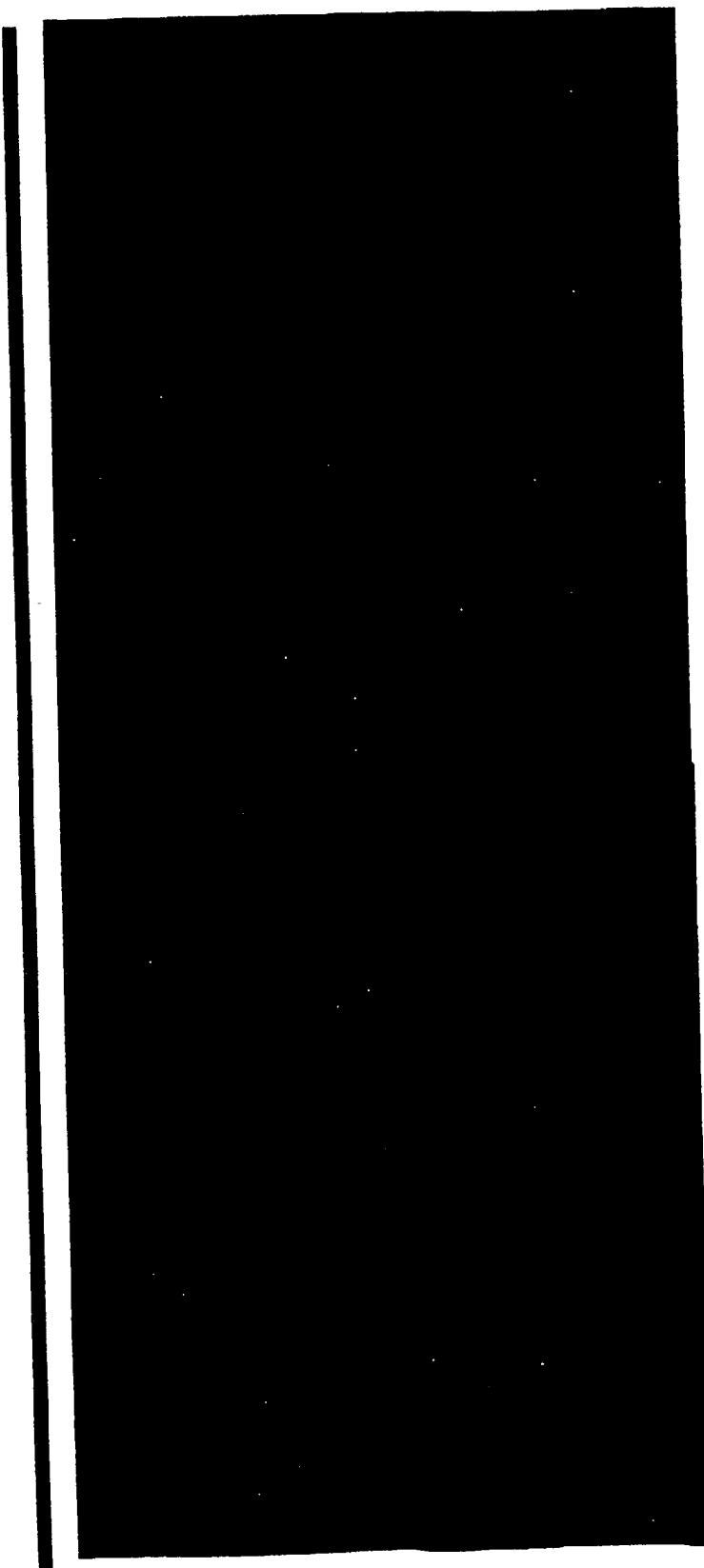
Figure 21b

Figure 21a
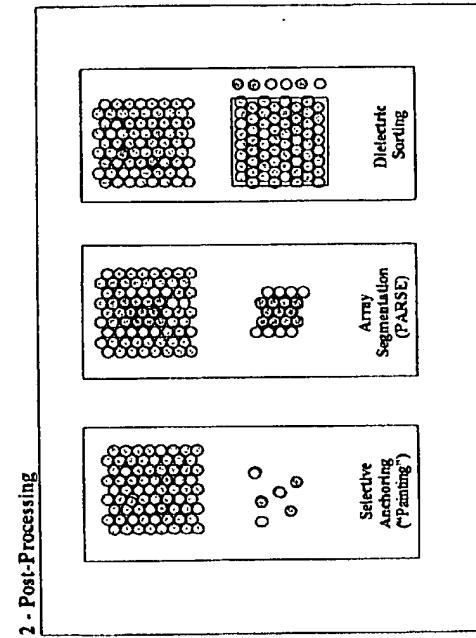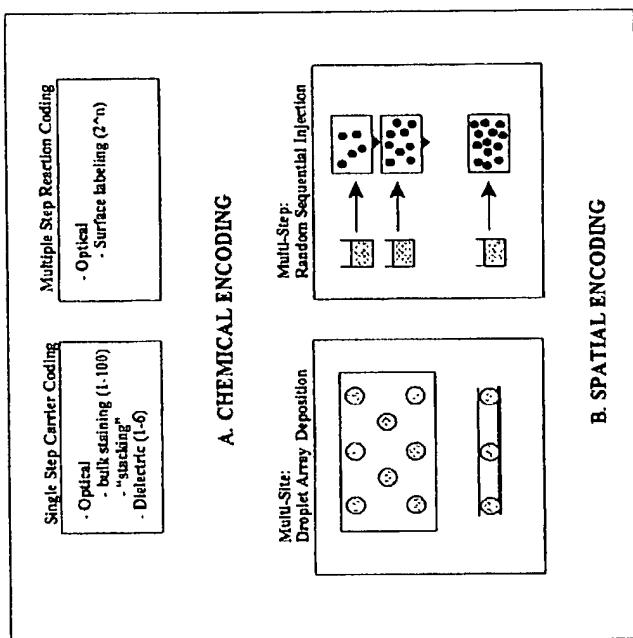
Figure 22a

Figure 22b

RANDOM SEQUENTIAL INJECTION
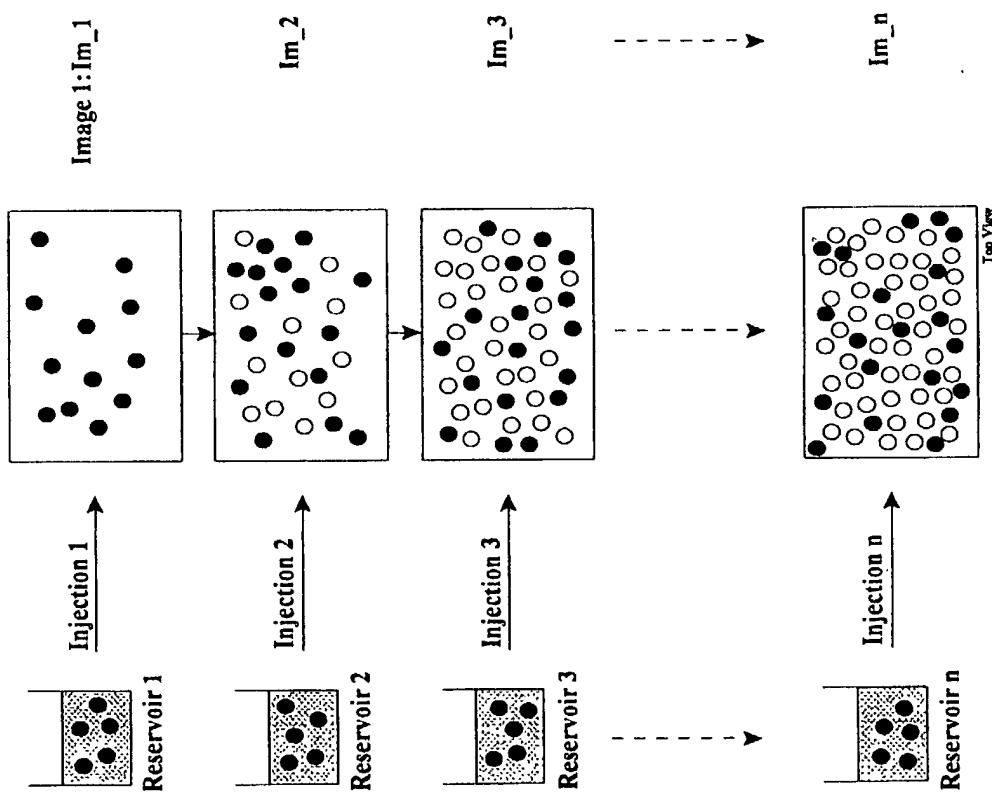
Figure 23

SEQUENTIAL INJECTION & LIGHT-CONTROLLED ARRAY PLACEMENT
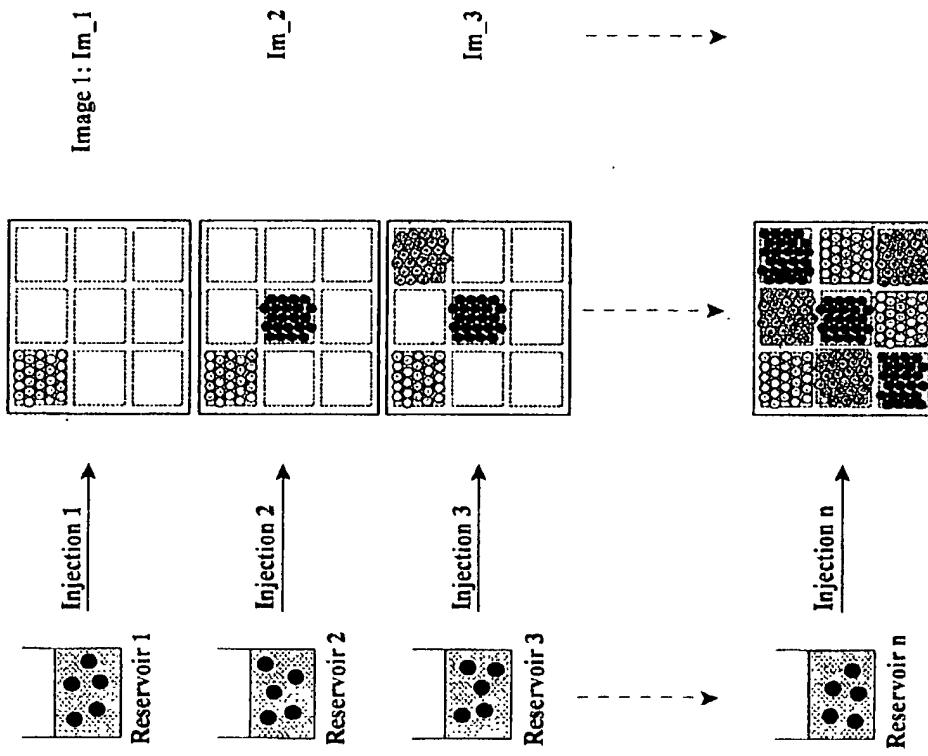
Figure 24

MACRO-TO-MICRO TANSITION

WELLS

CHIP

BEAD
ARRAYS
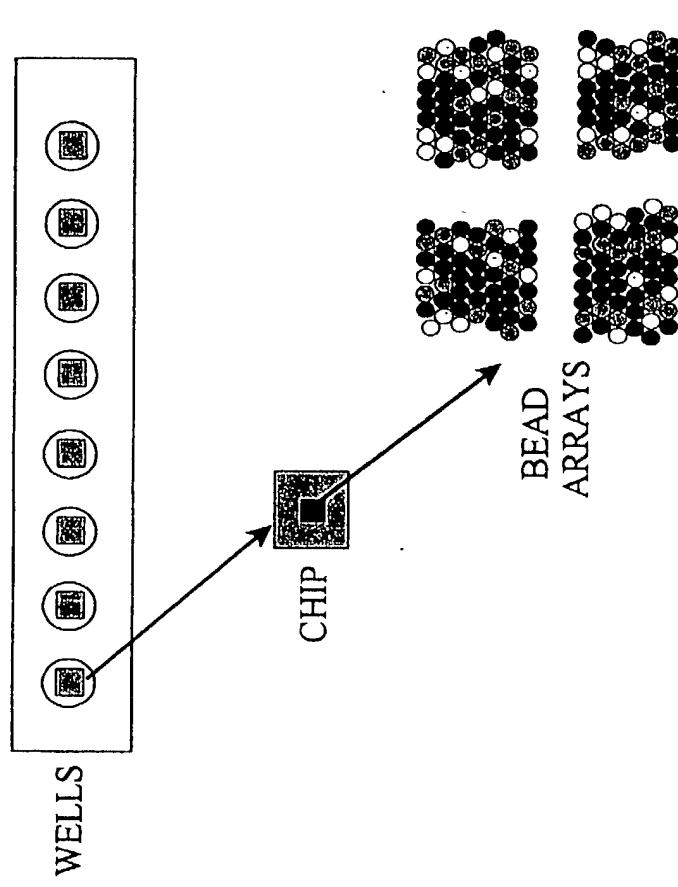
Figure 25a

ARRAY ENCODING
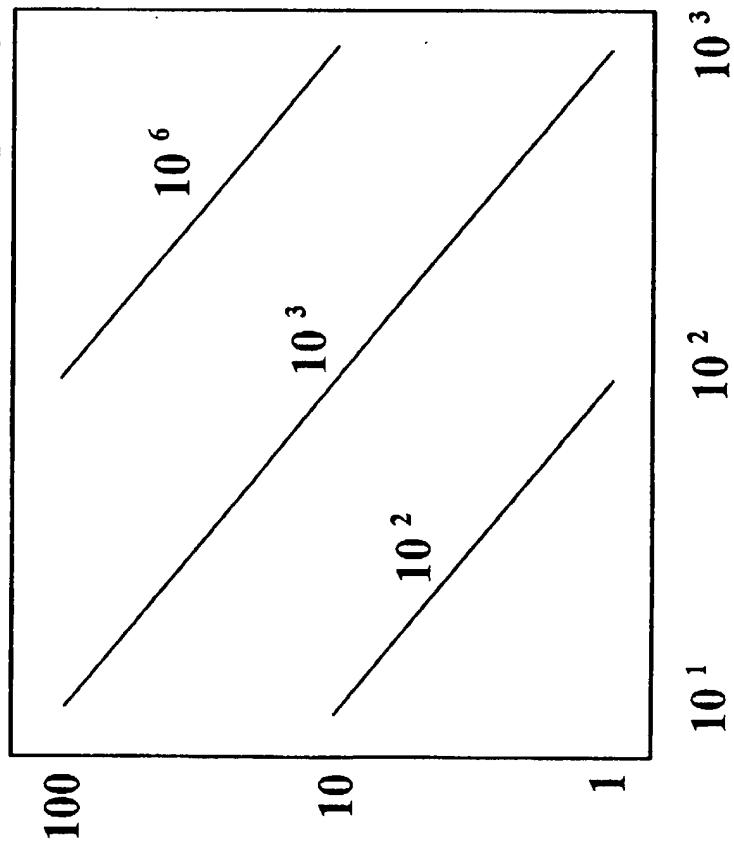
Figure 25b

ARRAY ENCODING

Reservoirs

r1 r2 r3 r4

Chip With
Multiple
Bead Arrays

r5 r6 r7 r8

Reservoirs
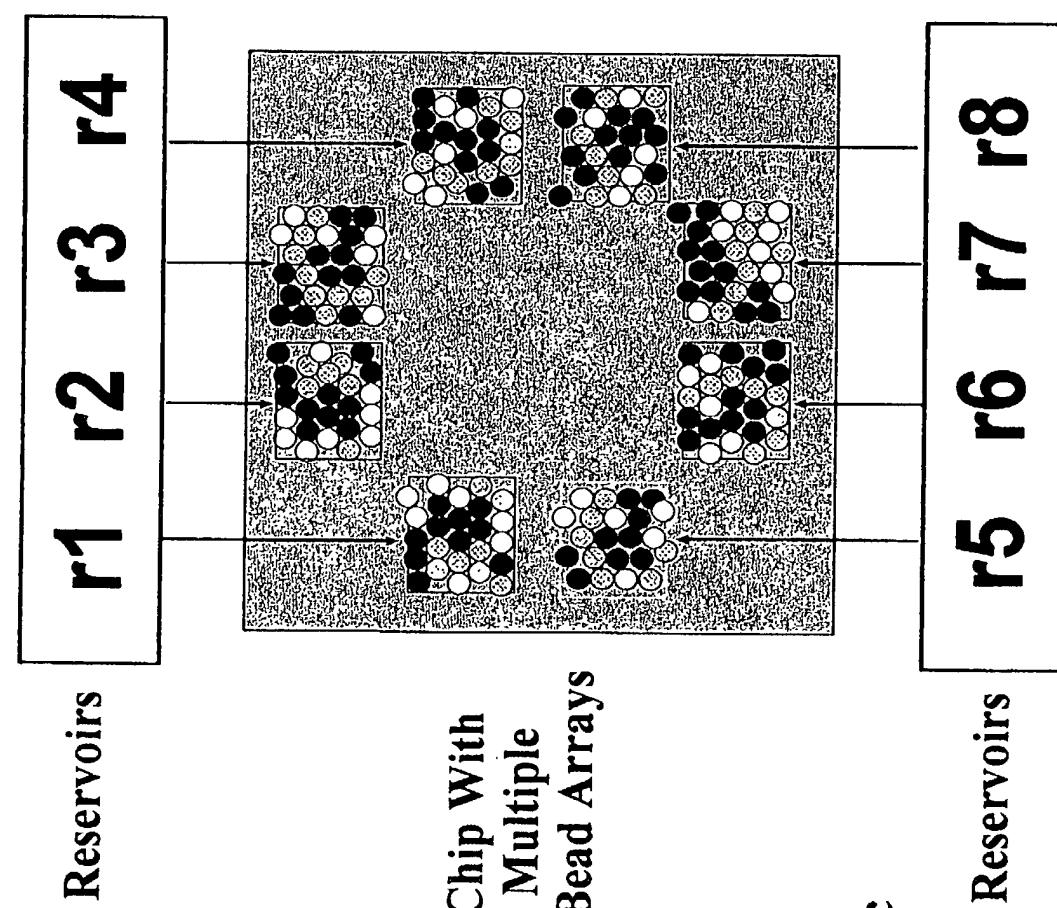
Figure 25c

SEQUENTIAL ASSEMBLY: "BANDING"
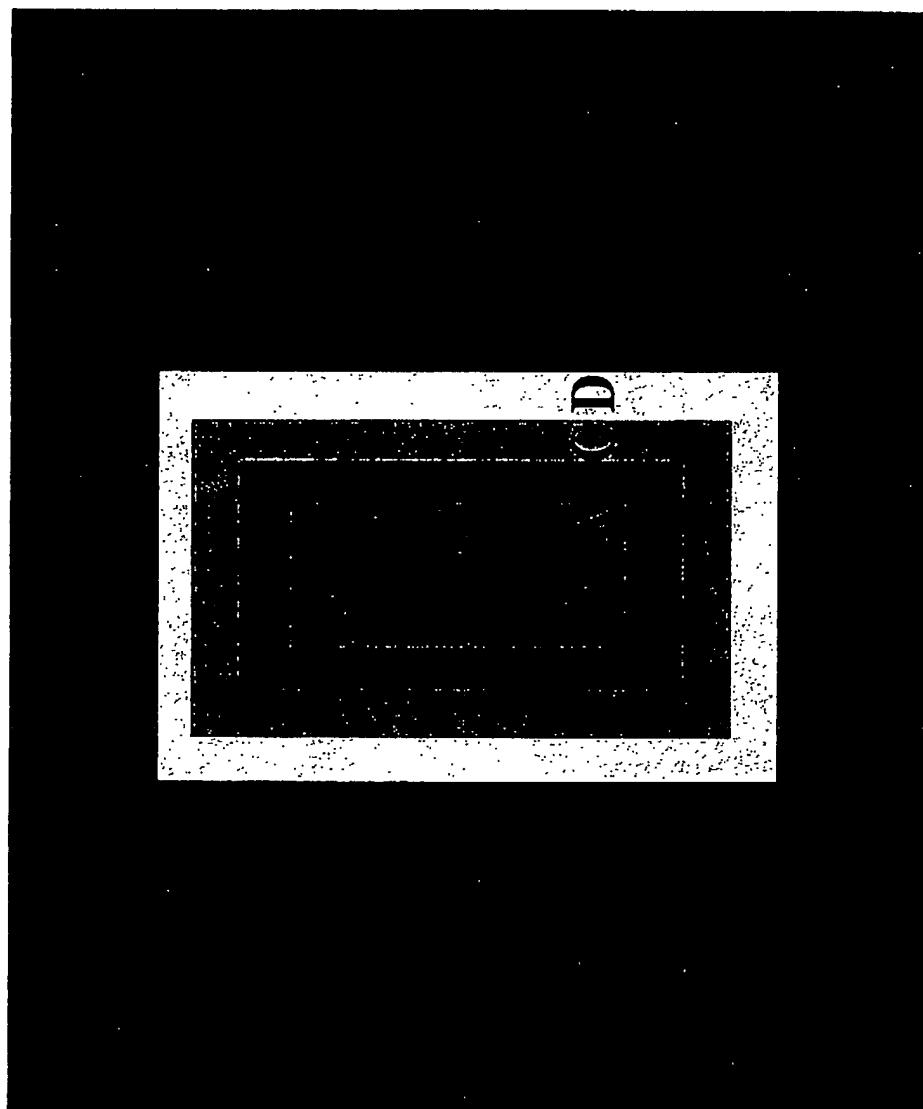
Figure 26a

SEQUENTIAL ASSEMBLY: "BANDING"

Mixture of Two Particle Types

Darkfield Image

Brightfield Image

5.5 μm

2.8 μm

2.8 μm 5.5 μm
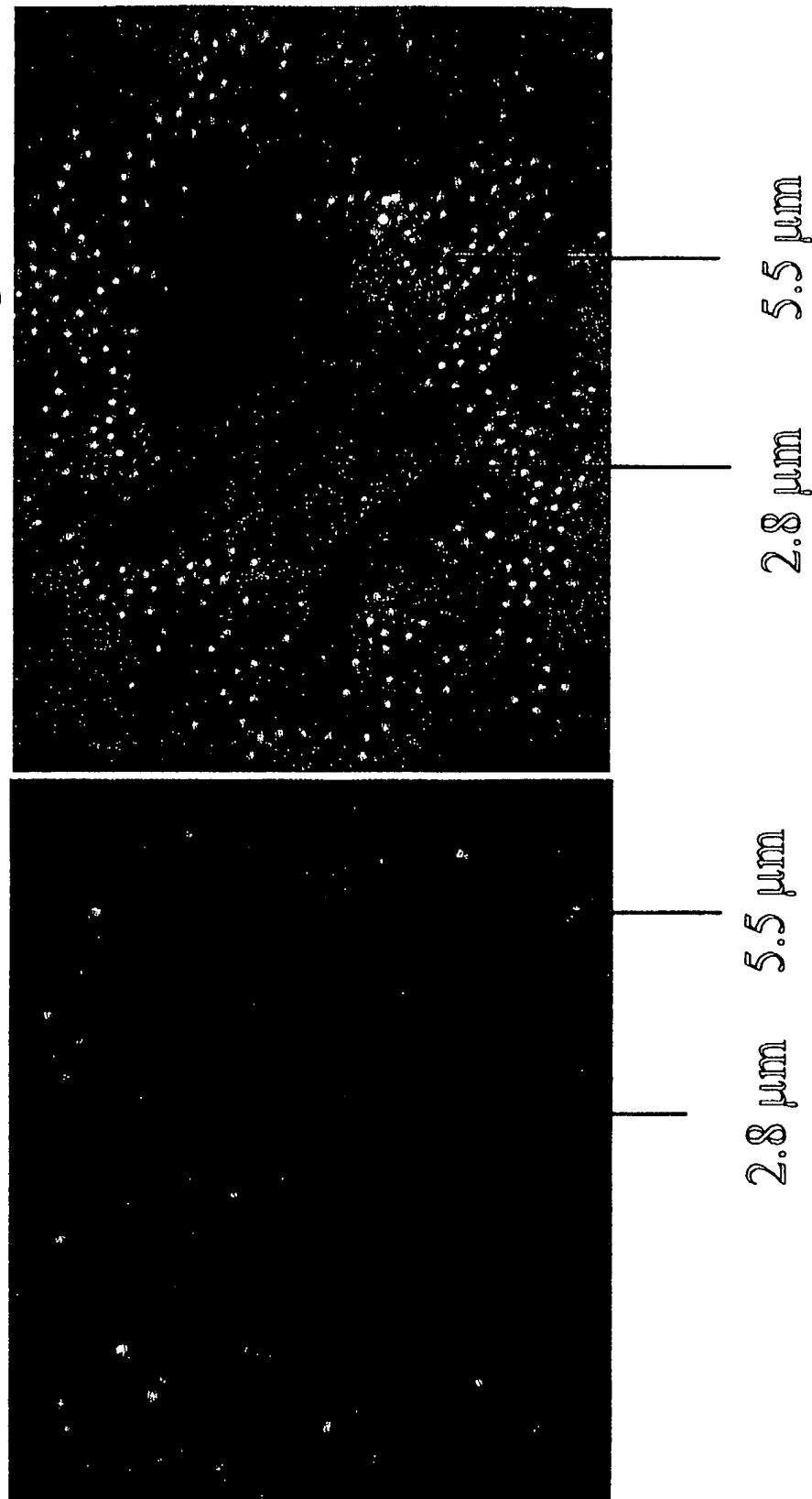
Figure 26b

LCD PARSE
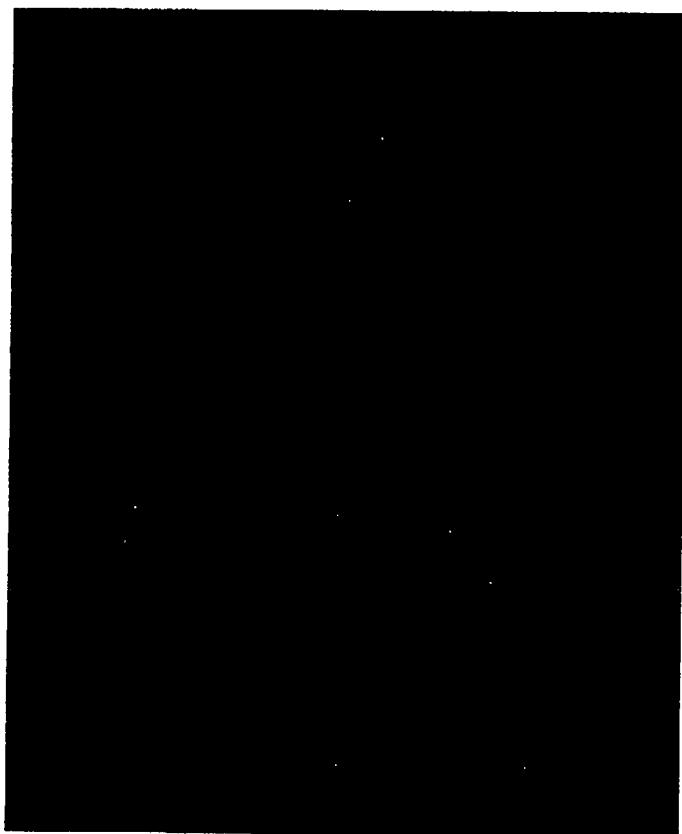
Figure 27

ARRAY OF RANDOM SUBARRAYS

A UNIQUE TWO-DIMENENSIONAL BAR CODE
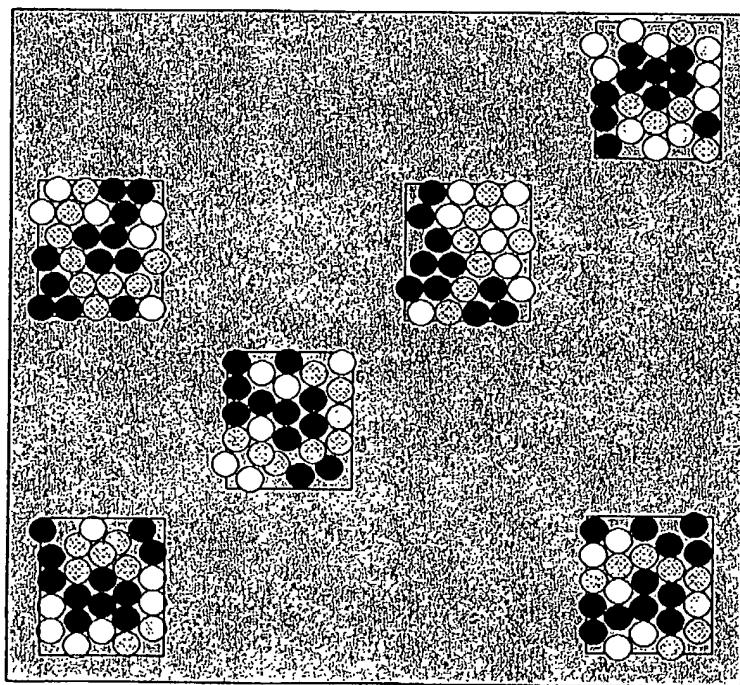
Figure 28

LIGHT-INDUCED FLUID FLOW

Figure 29